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K N Toosi University of Technology
Faculty of Electrical Engineering
Center of Excellence in Computation and Characterization of Devices and Subsystems

The Second Iranian Conference on Engineering Electromagnetics (ICEEM 2014), Jan. 8-9, 2014

Iranian Scientific Society of Engineering Electromagnetics

Apodized Sidewall-Corrugated SOI Waveguide as a Tunable Bragg Reflector

A. Karimi*, F. Emami, and N. Nozhat

Faculty of Electrical and Electronic Engineering, Shiraz University of Technology, Shiraz, Iran

***Corresponding author: az.karimi@sutech.ac.ir**

ABSTRACT— An apodization function for a silicon-on-insulator (SOI) strip waveguide with the sidewall corrugated gratings is investigated. It is shown that the implementation of the apodization results in a totally smooth reflection spectrum with no side lobe oscillation. Moreover, tailoring the Bragg wavelength of the grating structure is carried out by altering the waveguide dimensions. A blue shift of 6.7nm and a red shift of 3.6nm in the Bragg wavelength are achieved by decreasing and increasing the width of the strip by 20nm, respectively. Additionally, reducing and enhancing the thickness of the strip by 0.4nm and 1nm lead to a blue shift of 5.2nm and a red shift of 8.5nm in the Bragg wavelength, respectively. The flat spectrum and the capability to tailor the Bragg wavelength make the structure a good candidate for optical communication systems and networks.

KEYWORDS: Apodization, Bragg gratings, SOI waveguide, Wavelength filtering.

I. INTRODUCTION

Optical communication is a promising technology to handle the increasing demand for high-bandwidth, long-distance and safe communications. The high performance of the complex optical communication networks can be insured by using compact and integrated optical components. A large variety of the integrated optical components are based on Bragg gratings [1]. Prevalent examples are grating-assisted couplers, filters, grating-based plasmonic structures, sensors and lasers [2]-[6].

In the past decades, the realization of the grating-based integrated optical components such as grating couplers and filters on the silicon-on-insulator (SOI) waveguides have been widely investigated [2], [3], [7]. The compatibility of the SOI technology with the CMOS facilities makes this technology an attractive candidate for the integration of optics and electronics for optical communication systems. Often, grating is placed on the top [8] or the sidewalls [2] of the SOI waveguides. Positioned the grating on the top of the waveguide requires separated lithographic steps. However, the creation of the grating on the sidewalls of the waveguide can be performed by a single lithographic step [1].

SOI strip waveguides are one of the structures widely investigated for integrated-optical components. Examples include grating assisted couplers, wavelength filters, WDM add/drop filters based on coupled gratings and refractive index sensors [5], [7], [9]-[11]. These